- **The likelihood of constituent mobility within ground and surface waters on and near the project site. Is there a possible effect on the water that flows into wetlands and streams on or near the proposed project site? If so, is it possible to categorize or anticipate the scope or effect the proposed action will have on these waters?**

  Most all of the materials that will be removed during mining operations contain sulfides. Exposing this material to oxygen and water is expected to mobilize constituents from the mined/backfilled material at concentrations exceeding GSI criteria. Table 5-1 of the Foth modeling report estimates the projected pore water concentrations for several constituents of concern. These values exceed generic DEQ GSI criteria. The modeling report (Foth) attempts to demonstrate that these constituents will not be an issue by using a diffusion calculation (Fick's law) to show that the final concentrations will be below GSI criteria. However, using Fick's law in this way is both inappropriate (Fick's law is for one dimensional situations) and based on incorrect assumptions (i.e, the groundwater concentration gradient is calculated with a zero constituent background) and does not accurately reflect the constituent loading to the groundwater. The concentration of constituents in groundwater should be based on pilot tests that reflect the three dimensional impact of the waste rock. If concentrations are to be modeled, they should be modeled numerically with the entire volume of sulfide deposits, capable of mobilizing constituents, modeled as a whole.

  Based on my review of the available data, the proposed mining activities will mobilize constituents and ultimately impact nearby groundwater and surface waters at the site. The use of carbonate to mitigate the effects of the ARD has been proposed for when the pit is backfilled. However, the amount of carbonate required would be enormous and the logistics/reliability of such a proposal would require a detailed plan with confirmatory pilot tests. Such a plan/report has not been provided in either the modeling report or the Mining application.

- **Is there a possible discharge to the Menominee River on or near the project site? If so, is it possible to categorize or anticipate the effect the proposed actions will have on these waters?**

  There is a high likelihood that elevated constituent concentrations will be observed in the groundwater that discharges to the Menominee River and the Shakey River. Hydraulic conductivities indicate that flow into and through the surrounding material will occur at all depths of the excavated area. However, groundwater flows/hydraulic conductivities are expected to be much higher in the shallower zones and decrease with depth. Significant flow through the host rock (crystalline precambrian) is evidenced by several residential wells in the area that extract their water solely from these crystalline Precambrian units. Given the hydrogeologic setting, impacted groundwater from the backfilled pit is expected to migrate to local surface water sources. Assessing these

impacts would require an in depth analysis using three dimensional methods. Such an analysis is not available in the documents currently available to me.

- **If there is a potential for constituent loading and discharge to ground and surface waters, would the action be otherwise lawful under NREPA. Specifically, would this activity as currently proposed required a permit to discharge under other applicable Parts (i.e. Pt 22, 31, NPDES) of NREPA?**

  It is the DEQ's Water Resources Division (WRD) opinion that this activity would either require a Part 22 groundwater discharge permit or demonstrate that no discharge from the proposed mine area into the groundwater aquifer would occur. To demonstrate that no discharge occurs would require the pit to be lined per Part 22 Rule 2237 liner requirements, or the applicant would have to demonstrate equivalency of such.